Using the VideoEdge IP Encoder with Intellex IP

This application note explains the tradeoffs inherent in using IP video and provides guidance on optimal configuration of the VideoEdge IP encoder with Intellex IP. The VideoEdge IP Encoder is a high performance video encoder capable of serving multiple video streams at 4CIF resolution and up to 30 images per second per stream. The VideoEdge IP Encoder is the first video encoder using American Dynamics Active Content Compression (ACC) that is compatible with the Intellex IP Digital Video Management System. The new combination of Intellex IP, Network Client and VideoEdge IP Encoder provides a powerful new solution for security applications.

IP Video Basics

IP video uses Ethernet to transmit the video information from the IP encoder (or IP camera) and the Intellex IP unit. To accomplish this, first the analog video signal is digitized in the encoder and then compressed using the ACC compression algorithm. The VideoEdge IP uses a Digital Signal Processor (DSP) to perform the compression and network functions. Once the image data is compressed it is treated just like any other digital information on the network and is transported across the network using the TCP-IP protocol. Once it is received by the Intellex IP the digital video information is decompressed (so that it can be displayed live locally or with Network Client) and then selected frames are recompressed for storage. One new capability available with the VideoEdge IP Encoder is that the live image display rate can be different than the image record rate. The live rate is configured on the IP Sources setup screen in Intellex IP and the record rate is set up on the Rate setup screen on the Intellex IP. The record rate is limited to be less than or equal to the live rate. Compressing and decompressing the digital video is a significant load on the DSP in the encoder and the CPU in the Intellex IP.

Configuring the VideoEdge IP Encoder with Intellex IP

The overall system performance is largely determined by how the encoder and Intellex IP are configured to work together. Configuring the VideoEdge IP Encoder for use with Intellex IP involves setting the capture parameters on the encoder and setting the record parameters on the Intellex IP. The encoder settings determine the live image characteristics and the record settings affect characteristics of the playback video on the Intellex IP. There are some factors that must be considered when configuring these products to work as a system:

- The encoder settings determine the live image quality and the upper limit of the record image quality.
- The encoder settings and image motion (or noise) affect the encoder DSP loading.
- The encoder settings determine the amount of data loading the network.
- The encoder settings and image motion (or noise) have the greatest impact on Intellex IP CPU loading.
- The total load on the Intellex IP CPU is determined by:
    - Encoder settings
    - Image motion and noise
    - The record settings on the Intellex IP
    - Driving a local monitor with Intellex IP
    - Number of Network Client connections

Each of these factors will be considered separately.

Encoder Settings

The VideoEdge IP Encoder can be configured to set the image capture rate, resolution, and compression quality for each of the video inputs. The settings available are:

- **Rate:** 1 ips to 30 ips
- **Resolution**: CIF, 2CIF, 4CIF (with/without deinterlacing)
- **Quality:** Super, Normal, Extended Record

- **Motion Sensitivity:** High, Normal

The VideoEdge IP Encoder is capable of capturing, compressing, and transmitting 30 ips per video input at the highest resolution and quality settings for low to moderate levels of motion on each camera for a total of 120 ips. As the motion becomes more severe, the load on the DSP increases until the maximum image rate begins to drop off at the highest resolution and quality settings. An example of high motion would be panning cameras on some or all of the video inputs.

When the image resolution is 2CIF or less the image rate is 120 ips regardless of the quality settings or the amount of motion. Where ever possible it is important to mix the fixed cameras and domes between the encoders so that no more than three cameras on a single encoder can be panning at any one time.

Each Video Edge IP encoder can support multiple connections, so that a user can record data on Intellex IP, while using a browser for live viewing. Remember that each connection adds to the load on the encoder DSP and will limit the total image rate. (Network Client connections add load to the Intellex IP but do not affect the loading on the encoder.)

Recommendations

- Mix fixed cameras and domes on each VideoEdge IP Encoder to reduce the chances of simultaneous severe motion on all cameras connected to a single encoder.
- Minimize the number of connections to each encoder and if multiple connections are necessary reduce the resolution, rate, and quality on the backup connections.

- Avoid using cameras that get very noisy in the dark in day/night situations. Select a camera that delivers a usable image under the expected lighting conditions.

Network Data

The network bandwidth required for each VideoEdge IP Encoder also depends on the configuration settings of the encoder and the amount of image motion. Table 1 summarizes the amount of network traffic per camera under motion and still image conditions. The network traffic is in bits per second per camera at 30 ips.

Table 1

	4CIF Super/High De-interlacing Enabled	4CIF Super/High De-interlacing Disabled	2CIF Normal/Normal
Panning Camera	6.6 Mb/sec	6 Mb/sec	2.8 Mb/sec
No Motion	1.2 Mb/sec	1.2 Mb/sec	210 Kb/sec

There is a 29X increase on the network traffic between no motion at 2CIF and high motion at 4CIF! And the network traffic from 16 cameras could saturate a 100Mbit network! It is important when designing the network transporting the video data to isolate the encoders with a high quality gigabit switch so that the traffic on the 100 Mbit segments is minimized.

Recommendations

- Use quality Gigabit switches to isolate the network traffic.
- Use a dedicated network (not the corporate network) for video data.
- Use one of the Intellex IP NICs for the encoders and IP cameras and the other NIC for Network Client.

Intellex IP CPU Loading

The CPU load on the Intellex IP is determined by all of the configuration settings but some have more effect than others. Table 2 lists the typical incremental CPU loading for each of several system settings.

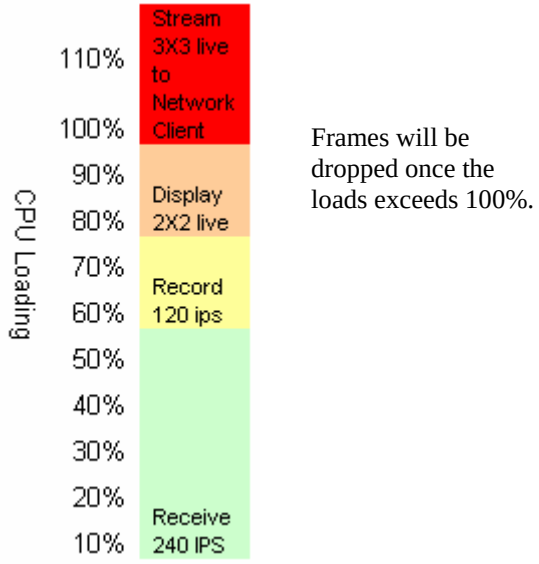

Table 2: Incremental CPU load

The greatest CPU load is handling the 240 images per second coming from the connected encoders. The next highest load is driving the main monitor and sending images to Network Client. In this scenario it would be possible to receive 240 ips of 4 CIF images, record 120 ips of 4CIF images and either display live on the main monitor (CPU loading 83%) or display live on Network Client (CPU loading 83%) but not both (CPU loading 103%). As the CPU load approaches 100% the Intellex IP drops frames being served to the Network Client for live display and drops frames from recording. Two important things to minimize the CPU load on the Intellex IP are to 1) configure the encoders to deliver the minimum live rate necessary for the application, and 2) configure the Intellex IP with the main monitor disabled if live surveillance is not being done or if live surveillance is via Network Client. The main monitor can be disabled by enabling classic security and logging out of the Intellex.

Recommendations

- Limit the total encoder image rate to 240 4CIF ips per system. This would be 4 encoders at 15 ips per camera or two encoders at 30 ips.
- Try to balance resolutions, rates, and expected scene motion across the encoders and Intellex IP units where possible.
- Enable security and log out of Intellex if local live surveillance is not needed in order to reduce CPU load. Disconnecting the VGA monitor does not drop the CPU load.

Performance on Legacy Intellex IP Platforms

Intellex IP was built on a Dell PowerEdge 750 server prior to July 2007. After July 2007, the platform is a Dell PowerEdge 860 server. The older server can be upgraded to Intellex software version 4.12 but the performance will be limited because of processor and motherboard limitations. Unfortunately, hardware upgrades are not practical for the PowerEdge 750. In general, the CPU loading is twice as high on the PowerEdge 750 compared to the PowerEdge 860 under the same conditions of live rate, resolution, and record rate. The difference between the PowerEdge 750 and 860 models is that the PowerEdge 750 has a floppy drive in the right hand drive bay and a single USB connector in front, while the PowerEdge 860 has no floppy drive and dual USB connectors in front.

Recommendations

- Limit upgraded PowerEdge 750 servers to two VideoEdge IP encoders per server.
- Limit the encoder image rate (the live rate) to 15 ips per camera.